

Surface Densification of Reusable Surface Insulation Tiles

Engineering Directorate

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REVISIONS		
VERSION	CHANGES	DATE
Baseline	Original version	6/5/98
A	Reviewed per QMS requirements. Removed reference to NDE (not applicable) in 3.1. Corrected reference to paragraphs 7.1 and 7.2 (was 8.1 and 8.2) in 3.1. Corrected reference to SOP-007.1 (was EM-007.1).	2/5/02
B	Clarified Level 2 definition. Updated material specification references. Added BRI-18.	4/05/07

1.0 **SCOPE**

This PRC establishes the requirements for densifying the IML surfaces of existing Reusable Surface Insulation (RSI) tiles before the Strain Isolator Pad (SIP) is bonded.

2.0 **APPLICABILITY**

This specification shall be applicable whenever RSI densification is invoked per Section 3.0, "Usage".

3.0 **USAGE**

This section gives the requirements for the proper use of this process specification. In accordance with the drawing and part definition requirements of JSC 8500, "Engineering Drawing System Requirements", this standard manufacturing process shall be invoked by providing a process note in the applicable drawing or CAD model as exemplified in Figure 1.



Figure 1. Example of a process note for densifying RSI tile.

3.1 **LEVELS**

The "Level" designator governs the extent to which quality assurance provisions are applied and shall be specified in the process note on the basis of the following definitions:

- a. Level 1 — Level 1 processes shall include the practice of the quality assurance provisions as required by Section 7.1.
- b. Level 2 — Level 2 processes shall include the practice of the quality assurance provisions as required by Section 7.2.

4.0 REFERENCES

The following references were used to develop this process specification:

SOP-007.1	Preparation and Revision of Process Specifications
JSC 8500	<i>Engineering Drawing System Requirements</i>
MA0609-303	Surface Densification of Reusable Surface Insulation Tiles

5.0 MATERIAL REQUIREMENTS

5.1 DENSIFYING MATERIAL

In order to make approximately one gallon of densification slurry, combine 1265 grams of MB0115-036 fused silica powder with a quantity of MB0115-011 colloidal silica as described by the empirical equation below:

$$\text{Colloidal Silica (g)} = \frac{(\rho - 1.0253)}{0.000053}$$

ρ = density of colloidal silica (1.160 to 1.201 g/cm³)

The fused silica/colloidal silica slurry mixture shall be turned on a roller mill for one hour minimum prior to density evaluation. The evaluation shall be completed within 30 minutes after removal from the roller. The density of the slurry mixture as determined using weight and volume measurements shall be 1.37 ± 0.01 g/cm³. If the mixture density falls outside the required range, the density may be adjusted by the addition of colloidal silica when the density is high or by the addition of fused silica powder when the density is low. When the proper density is achieved, add 0.12 percent by weight of MB0115-048 silicon hexaboride. Roll the mixture on a roller mill until the boron silicide is uniformly dispersed in the densification slurry.

6.0 PROCESS REQUIREMENTS

6.1 WATERPROOF TEST

Determine if tile has been waterproofed prior to densification.

6.2 HEAT CLEANING

Tiles that absorb water shall be heat cleaned at the temperature of 1275°F ± 175°F for a minimum of 10 minutes prior to densification. Tiles that do not absorb water do not require a heat cleaning.

6.3 SURFACE PREPARATION

6.3.1 SURFACE

Area to be densified shall be a machined RSI surface. When previously densified, a minimum of 0.040 inch shall be removed prior to a second densification.

6.3.2 PRE-COAT

A densification pre-coat consisting of isopropyl alcohol shall be applied to tiles waterproofed prior to densification. Tiles that have not been waterproofed shall utilize a densification pre-coat consisting of 50% Colloidal silica and 50% deionized water applied at 2.0 ± 0.1 g/in².

6.4 DENSIFICATION

Apply material prepared in 5.1 to the IML surface and any holes to be densified in successive coats to attain weight gain of 5.5.1. Remove excess material so that no buildup is left on the tile surface after drying.

6.4.1 WEIGHT GAIN

Densification shall result in a weight gain of solids (water and alcohol excluded) within the limits presented in Table I.

Table I. Surface Identification Weight Requirements

Substrate	Specification	Weight Pickup Requirement (g/in ²)
LI-900	MC364-0006	0.4 – 1.9
LI-2200	MB0114-025	0.3 – 1.8
FRCI-12	MB0115-032	0.3 – 1.8
AETB-8	MB0115-049	0.4 – 1.9
BRI-18	MB0115-061	0.3 – 1.8

NOTES: 1. In calculating the surface area for the weight pickup on tiles with threaded inserts previously bonded to the tile, add 0.5 inch to the radius of the hole in the base material and subtract this area from the tile IML area.

2. In calculating the surface area for weight pickup of tiles with holes, use only the IML planform area.
3. When densifying holes only, weight pickup verification is not required.

6.5 WATERPROOFING

Densified tiles shall be waterproofed. Tiles shall be dry prior to waterproofing.

6.6 BOND STRENGTH

Densification of the tile bonding surface shall result in a bonded tile/SIP/structural strength at the tile interface to produce a minimum stress at a failure according to Table II.

Table II. Interface Strength Requirements

Material	Strength (psi)
LI-900	13
LI-2200	35
FRCI-12	50
AETB-8	29
BRI-18	57

7.0 PROCESS VERIFICATION

7.1 LEVEL 1 PROCESS VERIFICATION

Detailed procedures for Level 1 processing shall contain Mandatory Inspection Points (MIP's). These MIP's shall describe or refer to specific inspection methods and criteria with which to verify the quality of the composite part. MIP's shall, at a minimum verify:

7.2 LEVEL 2 PROCESS VERIFICATION

Level 2 is classified as a non-flight article. There are no special process verification requirements for Level 2 processing. Therefore, MIP's are not required.

7.3 VERIFICATION RECORDS

Traceable records for all MIP's shall be kept as quality assurance records.

7.4 PRODUCT ACCEPTANCE

Product acceptance shall be based upon evidence of compliance with the requirements of 5.1, 6.1, 6.2, 6.3, 6.4, and 6.5.

8.0 TRAINING AND CERTIFICATION OF PERSONNEL

Training of technicians shall be performed according to written detailed procedures. Proper training shall, at a minimum, be structured in such a way as to ensure that each trainee is capable of densifying tiles that pass Level 1 process verification criteria. Training and certification records shall be kept.

For work performed at JSC facilities, these requirements shall be satisfied by the training and certification of personnel per TI-9009-01.

9.0 DEFINITIONS